Electric Vehicle Supply Equipment (EVSE) Innovation: Streetlight Charging in City Rights-of-Way

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Project Overview

EVSE Barriers Addressed

- Availability of EV charging infrastructure.
- Consumer reluctance to purchase electric vehicles.
- U.S. dependence on petroleum

Budget

- Total project funding
  - DOE: $915,708
  - Collaborative: $1,332,901
- Funding FY19: $425,973
- Funding FY20: $1,502,611
- Percent Spent: 6.9%

Timeline

- Start: October 1, 2018
- End: December 31, 2021
- Percent Complete: 25%

Partners

- Metropolitan Energy Center (lead)
- City of Kansas City, MO
- Evergy
- Black and McDonald
- Lilypad EV
- Missouri University of Science and Technology
- National Renewable Energy Laboratory

Project Objectives

Objectives:

- Substantially increase access to electric vehicle (EV) fueling in Kansas City, with attention to future usage as well as equity concerns
- Offer consumers and businesses additional transportation choices
- Enable commercialization of affordable, energy-efficient transportation technologies

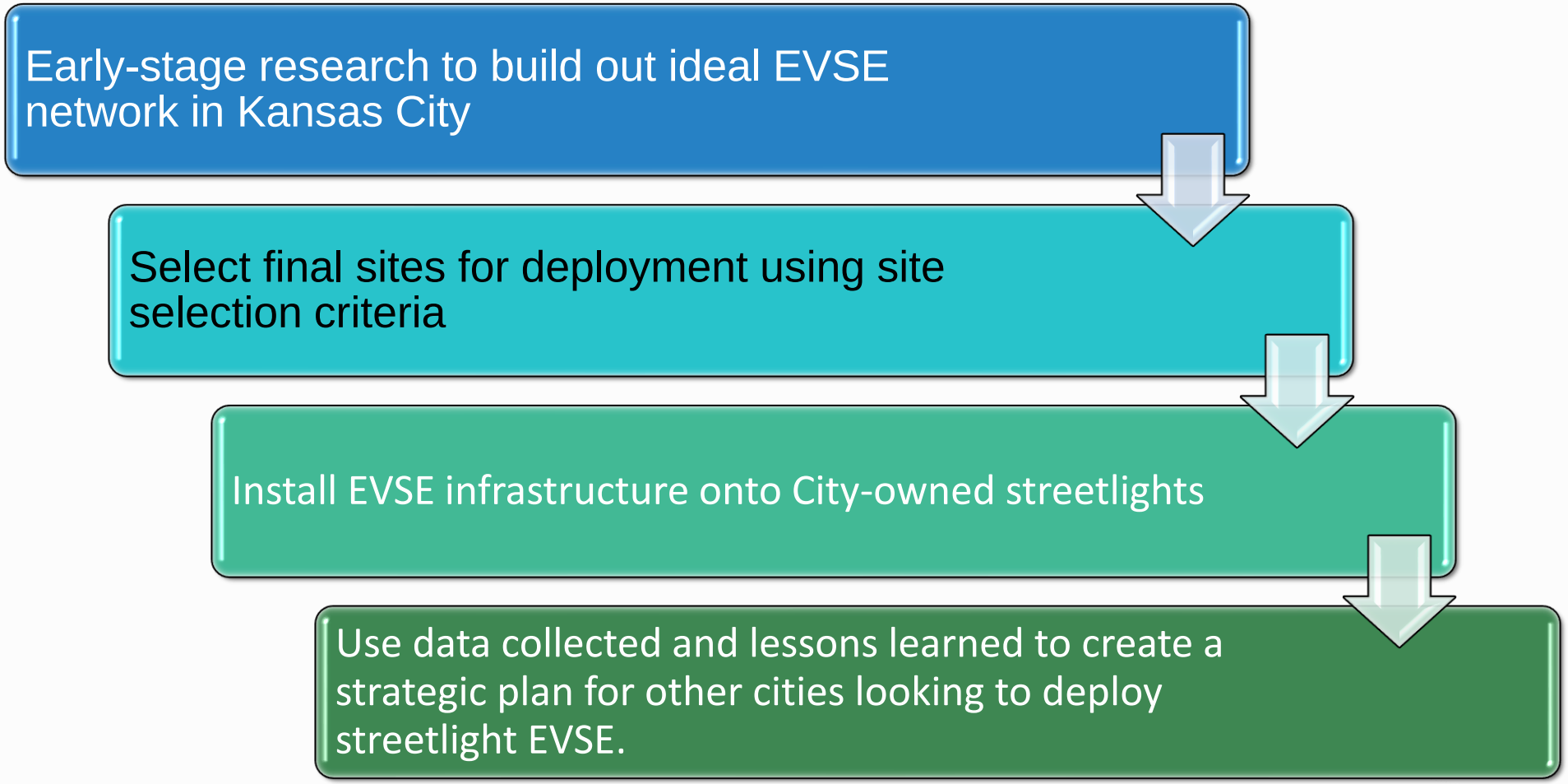
Tech Integration Goals

- National Security
  - Increases local fuel diversification
- Affordability for business/consumers
  - Saves money by utilizing existing infrastructure

Barriers Addressed:

- EVSE accessibility
- Consumer reluctance to adopt EV technology
- U.S. dependence on petroleum

Approach


Early-stage research to build out ideal EVSE network in Kansas City
Select final sites for deployment using site selection criteria
Install EVSE infrastructure onto City-owned streetlights
Use data collected and lessons learned to create a strategic plan for other cities looking to deploy streetlight EVSE.

Approach

Budget Period 1 – Design and Feasibility

- Study Design
- Pre-deployment Market Analysis
- Pre-deployment Demand/Supply Analysis
- City Feasibility

Go/No Go: Deployment Readiness

Budget Period 2 – Deployment and Monitoring

- Conduct Site Surveys / Select Deployment Sites
- Deploy Streetlight Charging at Recommended Deployment Locations
- Monitoring

Go/No Go: Deployment Completion

Budget Period 3 – Analysis and Reporting

- Final Study

Milestones

Critical Milestones	Deadline	Status
Design and Feasibility (Budget Period 1)		
Set Data and Modeling Goals	03/31/19	Complete
Select EVSE Technology	12/31/19	Complete
Ensure City Policy Conformity	12/31/19	In Progress
Select Sites for Evaluation	12/31/19	Complete
Deployment and Monitoring (Budget Period 2)		
Select Final Sites for Deployment	02/29/20	In Progress
Permitting for Selected Sites	04/30/20	Not Started
EVSE Installation Begins	04/30/20	Not Started
Install EVSE at Selected Sites	12/31/20	Not Started
Data Monitoring Active	12/31/20	Not Started
Analysis and Reporting (Budget Period 3)		
Process Documentation Available		Not Started
Analysis of Predictive Model Completed		Not Started
Results Disseminated in Print and at 2 Conferences		Not Started

Project Accomplishments & Progress

Select EVSE Technology

- Site surveys
- Analysis on grid infrastructure
- Evaluation of electricity monitoring options
- Create EV charger bracket and mounting design for streetlights

EVSE Barriers Addressed

- Availability of EV charging infrastructure.

Premise: Using existing streetlight infrastructure provides an affordable solution for building an urban EVSE network

Project Accomplishments & Progress

Build Market Demand Model

- Collect traffic, POI, existing network usage, and other data
- Create predictive model using weighted factors
- Generate 300 sites for further evaluation

EVSE Barriers Addressed

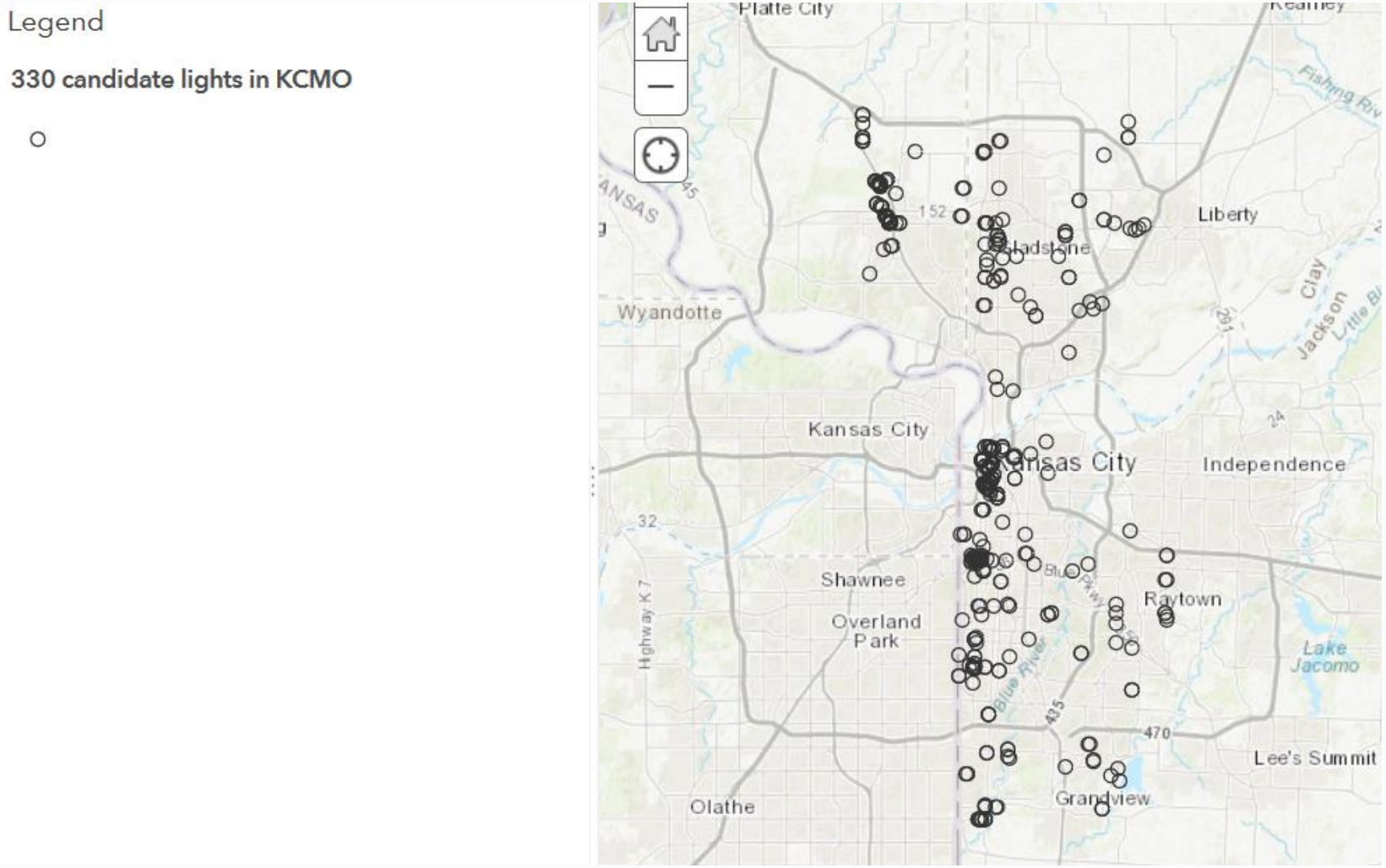
- U.S. dependence on petroleum

Market demand analysis incorporates future usage predictions into site selection

Market Demand Model

Points of interest evaluated (not all-inclusive):

- **Apartment buildings**
- **Restaurants**
- **Grocery stores**
- **Community centers**
- **Parks**
- **Churches**
- **Shopping malls**



Project Accomplishments & Progress

Build Underserved Model

- Determine working definition of underserved
- Collect data on EV ownership growth rates, neighborhood demographics, and environmental justice areas
- Create model identifying 3 different scenarios

EVSE Barriers Addressed

- Consumer reluctance to purchase new technologies.
- Availability of EV charging infrastructure.

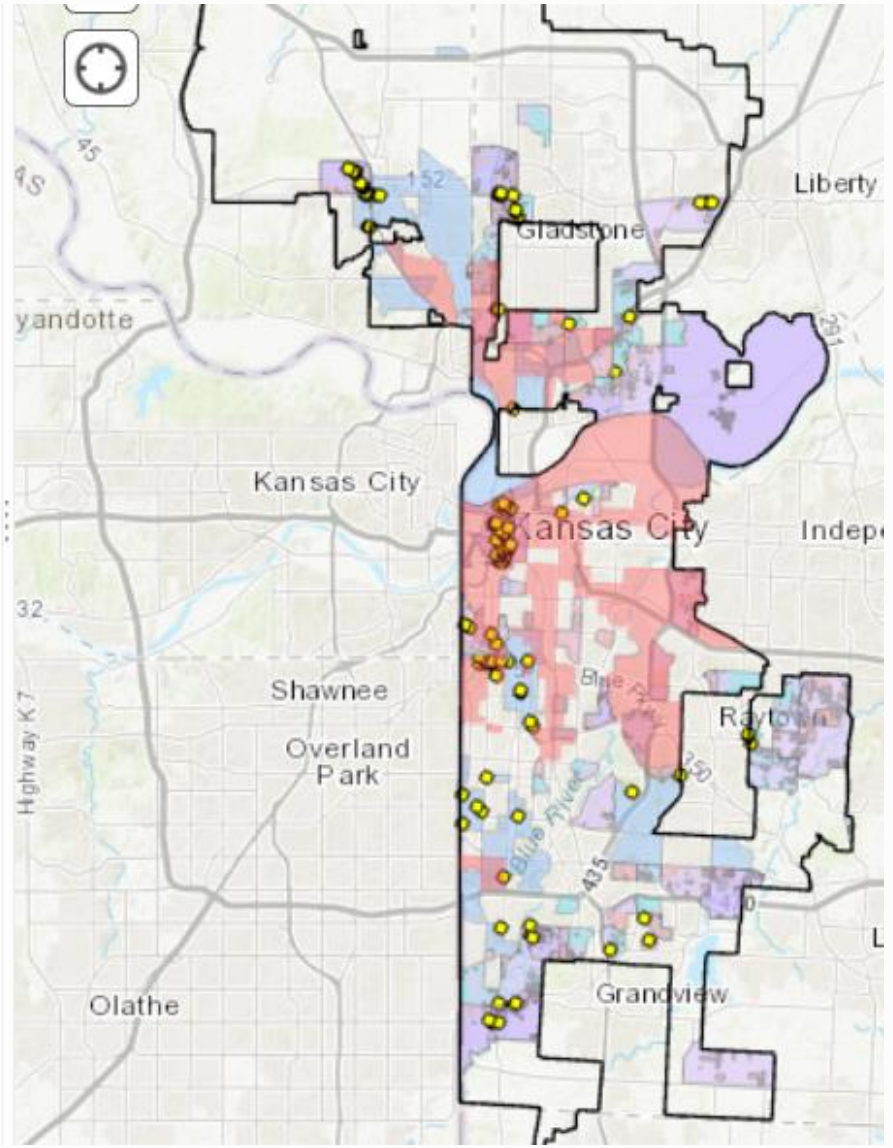
Lack of EVSE in underserved areas is a major contributor to consumer reluctance to purchase an EV

Underserved Model

Demographic data included in 3 different scenarios:

- **Air Quality**
- **Income level**
- **EV ownership growth rates**
- **Rentership rates**

- KCMO Streetlight Charging Analysis
  - EJ Screen Layers (High Traffic Proximity and Traffic Particulates)
  - City Limit
  - Scenario 3
    - Scenario 3 Streetlights
    - Scenario 3 Single Unit Dwellings
    - Scenario 3 Multi Unit Dwellings
    - Scenario 3 Areas
  - Scenario 2
    - Scenario 2 Streetlights
    - Scenario 2 Parcels
    - Scenario 2 Areas
  - Scenario 1
    - Scenario 1 Streetlights
    - Scenario 1 Parcels
    - Scenario 1 Areas



Project Accomplishments & Progress

Site Selection

- Collect data on parking, streetlight poles, electrical capacity, cost and city plans
- Eliminate sites that are costly or not conducive to EV charging
- Prioritize sites in underserved areas and sites with expected future demand
- Engage community and incorporate feedback

EVSE Barriers Addressed

- Affordability for business/consumers
- Availability of EV charging infrastructure.

Using data driven methods to select sites maximizes cost-benefit ratios

Collaborations and Coordination

Partners

- Evergy
- Missouri University of Science and Technology
- City of Kansas City, MO
- Black and McDonald
- LilyPad EV
- National Renewable Energy Lab

Community Outreach:

- EV Noire
- Shirley's Kitchen Cabinet
- Westside Housing

Overall Impact

Past Accomplishments

- Collected data on points of interest, community demographics, EV ownership growth rates, and environmental factors
- Created 2 overlapping site selection models to generate optimal candidates based upon selected weighted factors
- Created a spreadsheet of parking and streetlight data to eliminate unfavorable sites

Future Plans

- Engage community residents and incorporate feedback into site selection
- Deploy EVSE onto selected streetlights
- Monitor and collect data on deployed chargers

Project Summary

Objective

- Substantially increase access to electric vehicle (EV) fueling in Kansas City, with attention to future usage as well as equity concerns, while saving time and money by combining charging stations with existing streetlight infrastructure

Collaborations

- Metropolitan Energy Center (lead)
- City of Kansas City, MO
- Evergy
- Black and McDonald
- Lilypad EV
- Missouri University of Science and Technology
- National Renewable Energy Laboratory

Approach

- Build models using traffic models and weighted factors
- Select optimal sites based on site selection criteria
- Deploy EVSE on selected streetlights
- Collect data and monitor EVSE

Accomplishments

- Created a replicable process that uses models with weighted factors to generate candidate sites and then selects optimal sites based on various criteria

https://metroenergy.org/programs/clean-cities/projects/streetlight-ev-charging/

Technical Back-Up Slides

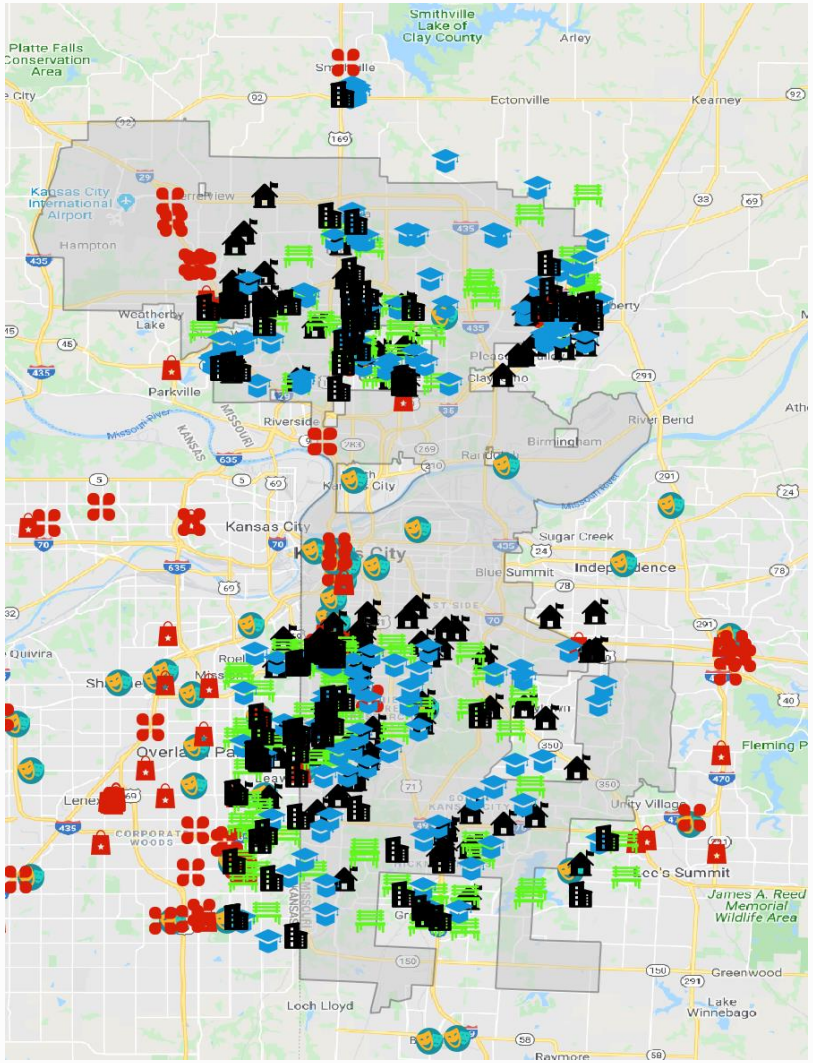
Market Demand Model - Process

Usage frequency was predicted with a Multiple Linear Regression (MLR) model created by Missouri University of Science and Technology. A 4-step prediction model was created with the help of 6-year charging event log data from Chargepoint, travel demand data from Mid-America Regional Council (MARC) and other data.

1. Define factors that affect the usage frequency of EVSE charging infrastructure
   - Existing charging station density
   - Traffic volume
   - Trip production and attraction
   - Land use types
2. Develop Linear Regression Model
   - Set existing charging station's daily usage frequency as dependent variable
   - Set defined features as independent variables
3. Retrieve a list of Point Of Interests (POIs) in Kansas City Missouri from Google Maps as candidate locations
4. Predict the usage frequency of candidate locations and select at least 300 streetlights with highest predicted usage rates for further evaluation

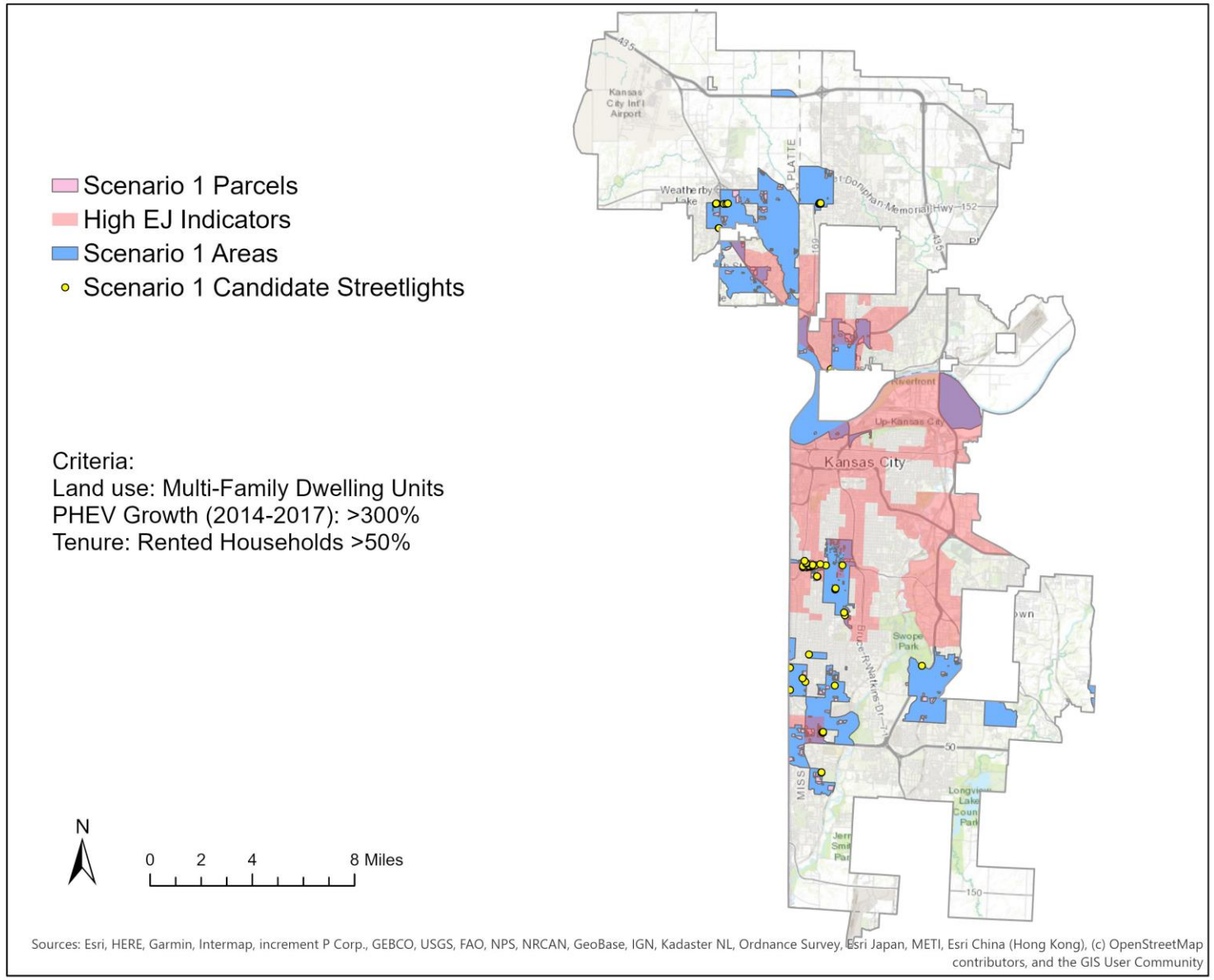
Market Demand Model – POIs

POIs	Count
apartment	59
bars	115
church	120
community	99
house	59
real estate	120
grocery store	58
hotel	60
park	91
plaza	58
shopping mall	56
school	119
restaurant	178
theater	60



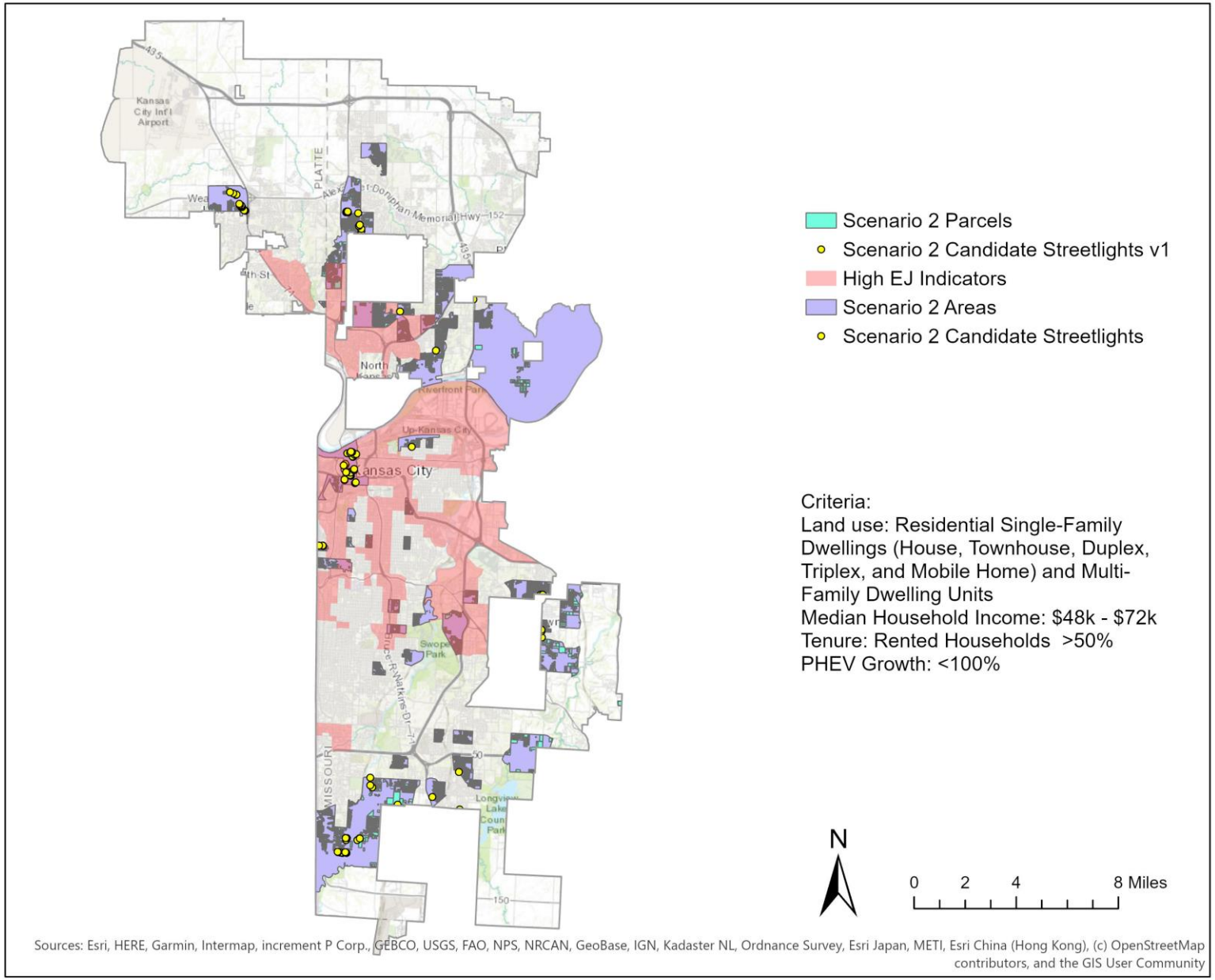
Underserved Model – Scenario 1

Created by the National Renewable Energy Laboratory



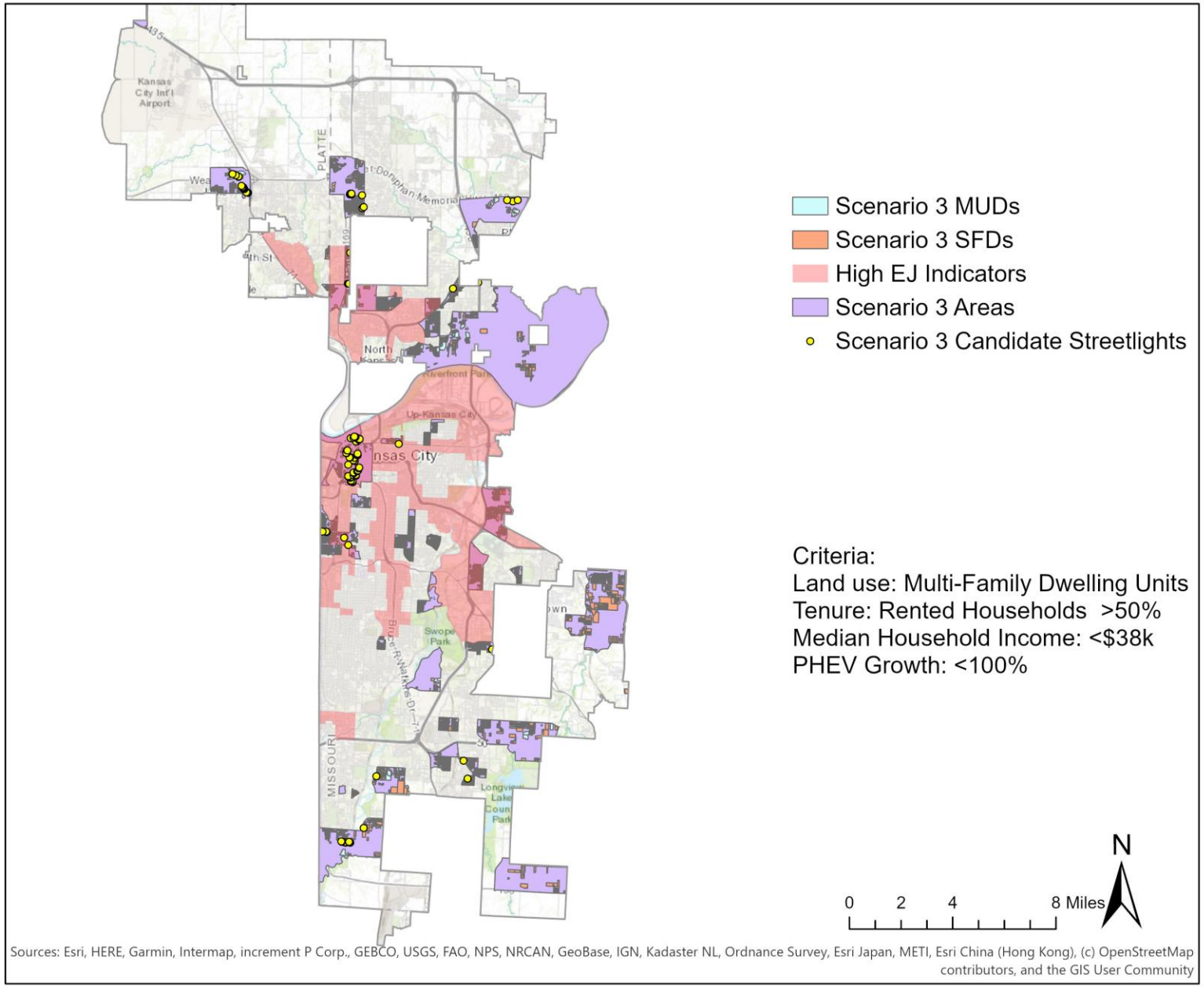
Underserved Model – Scenario 2

Created by the National Renewable Energy Laboratory



Underserved Model – Scenario 3

Created by the National Renewable Energy Laboratory



Reviewer-Only Slides

Critical Assumptions

- The City of Kansas City, MO and Evergy will continue to prioritize electric vehicle charging infrastructure and sustainable transportation
- EPA emissions standards will continue to show electric vehicles as having fewer lifetime emissions than conventional gasoline and diesel fuel vehicles
- State and local policy adoption will accelerate both availability of and demand for electric vehicles.
- Increased accessibility to EVSE will significantly impact decision-making process of businesses and consumers.
- Availability of EVSE will necessarily increase demand from individual and fleet consumers